SPONGE-GRAFTING.

By J. BURNETT, M.D.,

OF CARBONDALE, PA.

SINCE Dr. Hamilton, of Edinburgh, devised and described a method of sponge-grafting, with a series of illustrative cases, a number of tentative applications of his procedure have been made by various observers. I have succeeded in collecting a sufficient number of reported experiments to indicate with some exactness its possible uses and limitations. These experiments it is my intention to briefly summarize, adding a hitherto unreported case occurring in my own experience.

Of Hamilton's experiments, five in number, four were successful, the fifth failed. His first case was that of an ulcerated wound on the outside of the left leg, a circular excavation, five inches in diameter and one-half to three-quarters of an inch in depth. The usual methods of treatment having failed, it was grafted with sponge on August 3d, 1880. "On January 5th, 1881, the sponge had entirely disappeared, and there was merely a typically healthy granulating surface measuring about one and one-half inches in diameter. In the healing of this wound it seemed that instead of the edges and surrounding skin being drawn downwards and towards the center, as in the usual process of cicatrization, the reparative material had in reality grown up within the interstices of the sponge, and so had filled in the vacuity caused by the cellular tissue slough. It seemed to be, in every sense of the term, a process of healing up, instead of contracting down."

In his second case, a piece of sponge was employed as a compress in a wound resulting from the excision of an epithelionatous tumor in the neighborhood of the lower jaw, and having remained a few days, became adherent. The superficial portion was clipped off, and the remaining portion left in situ. The patient at this stage was dismissed and passed from under observation. The third case was under Mr. Bell's direction, consisting of an intractable ulcerated wound of long standing on the left leg, with much cicatricial contraction of surrounding parts. After failure of the usual expedients for procuring repair, amputation was contemplated, but on January 8th, 1881, the wound, measuring two and one-half by two inches, was grafted with sponge. In time the sponge was completely organized and the wound healed over.

The fourth experiment was in the case of a woman from whom Mr. Bell removed a large recurrent cancer of the mamma with some axillary glands, and a large portion of integument, leaving a gap of considerable size, which was filled with sponge. The operation was performed on February 3d, 1881. By the 13th it was vascular, and in the early part of July it had entirely disappeared, leaving a very small granulating surface partially covered with epithelium. The fifth experiment failed. The case was one of old necrosis of the tibia, communicating with a large sloughy wound in which the apparently dead extremity of the bone was visible. Sponge-grafting was attempted and failed on account of the absence of underlying blood-vessels to penetrate into its interstices. Dr. Norman Porritt has reported a case.[1] A pale granulating cavity, the result of a traumatism, four inches long, two inches in breadth, and one-third of an inch in depth, existed on the right cheek. On November 21, 1881, it was grafted with sponge. January 13, 1882, "patient dismissed. The wound is now three-fourths of an inch long, and one-fourth of an inch broad, and is healthy and granulating. Cicatrization is proceeding very rapidly indeed."

Dr. T. Sanctuary has detailed three cases of sponge-grafting.[2] One was a sloughing wound of the urethra, its superficies being rather larger than a sixpence. Five pieces of sponge packed into the wound produced prompt granulation and healing without contraction. The second was one in which the side of a terminal phalanx was shaved off, leaving a clean cut wound. It was grafted, and the finger was sound at the end of three weeks. In the third case there was a removal of part of the terminal phalanx, with extensive destruction of skin, and consequent slow healing. It was grafted, and healed completely in eight weeks.

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[1] *The Edinburgh Medical Journal*, May, 1882.

[2] *British Medical Journal*, December 16, 1882.

Dr. James Ferguson[1] has practiced a modified sponge-grafting in the case of an ulcer of three years' standing, of traumatic origin. The sore extended almost around the calf, measuring from two to five inches in width, its surface sloughy and of offensive odor. Its level was, for the greater part, almost that of the body surface, except at one angle where a deeply scooped-out depression existed. The excavated portion was sponge-grafted, and healed very slowly, but completely. The more elevated portions were grafted with skin, and excepting an area overlying bone, also healed. A space of an inch in diameter over the tibia sloughed off, leaving an ulcer one-quarter of an inch in depth, with a white, fibrous, non-vascular floor. This secondary ulcer was sponge-grafted, and after a few days the sponge was torn away, leaving a completely changed, vascular, bleeding level reaching well up toward the body-surface. Granulation proceeded rapidly and skin-grafts soon produced cicatrization. Another case is detailed in the same paper, of an ulcer, in which, after sponge-grafting, erysipelas (the patient being subject to idiopathic attacks) set in, and it was judged advisable to remove the sponge. Rapid granulation and healing followed as in the previous case. Ferguson judges that, whether the erysipelas or the sponge was the active agent, the latter was certainly a factor, and deserves future employment. He recommends temporary sponge-grafting for the purpose of stimulating tisue-growth and granulations. Hamilton's statement that the sponge-graft is destitute of nerve-tissue, he cannot sustain, pain being caused in his cases by pricking or cutting the graft after adhesion and vascularization had taken place.

Mr. de Lantour[2] reports a case of operation for cicatricial contractions of the hand, resulting from a burn, in which he filled the resulting gaps with sponge, and secured healing with very slight or no recontraction.

Dr. Royal Whitman[3] reports four cases in the service of Drs.

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[1] Ibid.

[2] *Australian Medical Journal*, April 15, 1883.

[3] *New York Medical Record*, October 7, 1882.

W. H. Thorndyke and C. D. Homans, at the Boston City Hospital. In the first case a suppurating and sloughing bubo existed in each groin above and below Poupart's ligament. The entire extent of Scarpa's triangle on the right side was exposed, showing the saphenous veins and the sheath of the femoral vessels. These surfaces soon began to granulate and were then sponge-grafted on March 13, 1882. By June 27, 1882, the sponge was absorbed, and only a small granulating surface, three-fourths of an inch in diameter, existed. The patient was then discharged. The second case was one having ulcers of long standing. Sponge-grafts were applied, and had reached the stage of complete vascularization, when they were torn out by the patient. The ulcers relapsed into their original condition. The third experiment consisted in the use of a sponge thrust into the medullary cavity of the femur, to control hemorrhage from it, during an amputation of the thigh. The sponge was left in the bone, and union of the entire wound took place by first intention, and all dressings were discontinued on the twentieth day. In the remaining case, sponge-grafts were used after an extensive amputation of the breast, but the wound healed slowly and the process of repair seemed to be retarded by the presence of the sponge.

Dr. W. G. Thompson[1] reports the successful grafting with sponge, of a large ulcer. I have already reported my first case of sponge-grafting,[2] in which six sinuses existed in the right side as the result of an abscess at the junction of the tenth, eleventh and twelfth ribs, and their cartilages. On account of the difficulty of accurately fitting the sponge to long narrow cavities, repeated trials had to be made, but finally all the cavities were healed, either by absorption and organization of the sponge, or by the stimulating action of the latter in exciting new tissue-growth.

My second case of sponge-grafting was done in Carbondale, Pa., in 1883:

James K———, a boy 12 years old, employed as mule-driver in a coal mine of the Delaware & Hudson Canal Co., was injured by being knocked down and run over by a trip of mine cars on Jan. 4th, 1883. I found, on examination, that along with a number of slight cuts and severe bruises, he, in some way which I could not explain, received an injury above the right ear, which tore away the scalp and periosteum for an area of 2½ inches by 1¼ inches, and left the bone completely bare. No part of these tissues were adherent, they were torn off and lost. I cleansed the wound and applied cotton wool saturated with carbolized oil. Forty-eight hours after the injury, after thoroughly cleansing the parts, I applied carbolized sponge, carefully prepared as directed by Dr. Hamilton, and fitted accurately to the wound. The sponge was about one-fifth of an inch in thickness, and was all in one piece, and the outside, or periphery of the sponge was applied to the bone. A carbolized compress was applied and fastened by a few turns of bandage. The wound was cleansed daily, but there was very little discharge, and on the fourth day the sponge had adhered to the upper edge of the wound. The progress which the graft made gave promise of a speedily successful issue in the case. The union of the edges all around the wound was complete on the tenth day, and very little suppuration had occurred. From this time until the fifteenth day the discharge increased in quantity and offensiveness. On the fifteenth day it was observed that the sponge bulged outward at the center, and upon investigation it was discovered that the edges only of the sponge adhered; the part in contact with the bone not having united at any point. The sponge was then removed and a small quantity of offensive pus was found in the wound cavity. Again the wound was cleansed antiseptically and the bone surface examined. A number of small red points upon its surface showed that action, though feeble, had been excited by the graft. Another piece of sponge was at once fitted to the wound and cleansed and watched daily. On the fourth day the greater part of the sponge had adhered at the edges of the cavity as before; some discharge began to ooze through the meshes of the sponge at first, not at all offensive, but after a week its character changed; it was thin, and gave off a disagreeable odor. This was probably in a measure attributable to the loose condition and scrofulous habit of the patient. Especial efforts were made to improve the nutrition of the boy, good food was provided in abundance, which, however, was not always well prepared, and syrup of the iodide of iron with cod-liver oil were given. He was, also, kept in the open air as much as possible at that season of the year, as his quarters at home were anything but salubrious. On the twenty-sixth day after the application of the last graft, it was noticed that the sponge was foul smelling and breaking down in the center, the edges closely adhering and granulating. With scissors and dressing forceps the central portion of the sponge was removed; it was a broken-down, pulpy mass, infiltrated with foul-smelling pus. It was deemed advisable to remove all the sponge, which was done, except a narrow band all around the cavity where granulations had penetrated its meshes. The sponge was trimmed off carefully all around until a vascular bleeding surface was reached. Measurement showed that the wound had been slightly narrowed by the band of granulation tissue all around its periphery. The wound was again cleansed thoroughly. Now the bone surface showed marked evidence of action; its surface was thickly studded with granulations; there was no exfoliation. Another piece of prepared sponge was fitted into the wound, and a piece of oiled silk and carbolized compress applied and fastened with a bandage. The edges of this last graft did not unite as rapidly as the former ones: there was no decided adhesion of the sponge until the 11th day, and then the process was much slower than on former occasions. A free discharge of pus came from the sponge and was washed away thoroughly three times daily with a solution of bichloride of mercury (1 to 2000). From this time on, union took place steadily, and on the twentieth day firm adhesion of the sponge to the bone as well as the edges of the cavity was obtained. The discharge gradually grew less, and on the 31st day from the application of the graft granulations were seen springing up through the sponge. The process of healing was uninterrupted afterwards, and in three months the sponge was entirely lost, and its place filled with granulation tissue, over which a film of new skin had formed, and which, in another month, was firm and smooth, but looked like a cicatrix. There was no further trouble with the case.

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[1] *New York Medical Record,* May 26, 1883.

[2] *New York Medical Record,* October 28, 1882.

This case presented a great many points of disadvantage. The boy was scrofulous, poorly nourished, wretchedly clad and housed, and the accident occurred at a time of the year when he could be out doors only a small portion of the time. The complete loss of tissue for so considerable an area would have been a serious matter without the exposure of bone, which materially complicated the case. Under the most favorable conditions the injury was a serious one, and could hardly be expected to heal without exfoliation of bone, skin-grafting, etc., always a tedious process. Tis true, a long time was taken to heal the wound, but it was much less than usual in the healing of such wounds under similar conditions.

The above enumerated cases seem to prove that sponge-grafting is a valuable means of healing a certain class of wounds. Dr. Hamilton and others have shown its utility in healing old ulcers which had resisted all other methods of treatment. Dr. Sanctuary's second case shows that the sponge can be used on a fresh wound; Dr. Lantour's case demonstrates its usefulness in filling up gaps make by the cutting and stretching of the cicatricized contraction resulting from burns. The third case reported by Dr. Williams, shows how innocuous aseptic sponge is when completely covered in the tissues. In this case Dr. Homans, after amputating a thigh, was obliged to plug the medullary cavity of the femur to arrest hemorrhage, but although the sponge remained and the patient's condition was bad, having suffered from necrosis and exhausting suppuration, "There was almost complete union by first intention, and the patient was up on the fourteenth day, and all dressings were omitted on the twentieth day." Dr. Whitman's fourth case, although unsuccessful, does not weigh against the use of sponge-grafts, as the results, after excision of cancer of the breast with diseased axillary glands, are uncertain, under all methods of treating the wound.

My own cases prove to me the utility of sponge-grafts when it certainly would have been difficult to obtain as satisfactory results by any other means; indeed, I doubt if any other known method would have effected a cure in my first case. All means which I and my consultants could suggest were used to arrest the disease, and the patient steadily grew worse, until he was reduced almost to a skeleton. He was irritable, restless, and nearly bereft of reason. Without a change in the wounds he certainly could not long have survived. Improvement began in his condition as soon as the healing process began, and continued steadily but slowly until he had regained his average of health, which, by the way, was never very high. The healing of the shallow ulcer in this case by the sponge, although it was thrown off, confirms the view of Dr. Ferguson, viz: that sponge may be used with advantage temporarily to excite granulation in indolent ulcers. For after applying it to an indolent ulcer for six days, and then removing it, he says of the ulcer: "What had been the type of indolence and obstinacy among such sores was now the picture of healthy action—the surface abundantly vascular and standing up towards the level of the skin. The simplest dressings were now sufficient to promote repair; and in three weeks from the employment of the sponge recovery was complete."

This case of Dr. Ferguson is, in a measure, contradicted by the second case of Dr. Whitman, for after the graft was doing well and uniting with the tissue; the patient tore out the sponge, and the healing process did not proceed farther.

My second case was, so far as I can learn, the only one in which sponge-grafts were applied on a bone surface to stimulate granulation, and although it failed twice, and was removed, the final result was all that could be desired. It would seem to offer a ready means of stimulating granulation in bone as well as in the softer tissues.

The number of cases here reported proves the undoubted utility of this method of treating indolent and intractable ulcers, wounds where there is loss of tissue, gaping wounds made by cutting and stretching the tissues (as in the cicatrices following burns), sinuses which can be accurately filled with sponge, and finally for stimulating granulations on bone. What other cases will be benefited by sponge-grafting the ingenuity of surgeons and their confidence in this means of treatment can alone determine.

Dr. Hamilton made careful microscopic examinations in his cases, which show the sponge at different stages of its organization with the tissues. He believes the process of organization is similar to that which takes place in blood clot. He also believes that no nerves are formed in the granulation tissue built up by the sponge. I do not deny that the cicatrix formed by a sponge graft is *poorly supplied by nerves;* but I think that the supply is as good as in ordinary cicatrices, the only difference being that by the use of sponge we get more cicatricial tissue—more new growth than by other means, and cicatricial tissue *per se* never has normal nerve supply.

My views as to the manner in which sponge-grafts heal wounds and ulcers were stated as follows (see *Medical Record*, October 18, 1882): Pressure has long been recognized as an important factor in the healing of indolent wounds and ulcers, and my observations in the foregoing case lead me to conclude that pressure—moderate elastic pressure with a pure animal porous substance, is the first essential in healing an indolent ulcer. Pressure with the sponge in the long, narrow sinuses of my patient had the same effect upon the walls of the cavities that Mr. Callender's hyperdistension of abscess has—both stimulate healthy granulation, the difference being that in the latter case a liquid is used which distends temporarily, and is then removed; in the former a semi-solid substance is allowed to remain and exert moderate equable pressure, and finally to become a part of the tissue. Sponge, from its porosity, is one of the best agents to thoroughly drain wounds and prevent septic absorption. This action of sponge was noticed more than a century ago by Mr. Charles White, of Manchester, in a paper entitled: "An Account of the Successful use of Sponge in the Stoppage of Hemorrhage occasioned by Amputation below the Knee, and the Remarkable Effects of that Application in Preventing the Absorption of Matter." Mr. White concludes his paper with these words: "The sponge keeps down fleshy granulations, partly by a removal of that matter in which they would be soaked, and partly by a compression, the most easy and equal that can possibly be imagined from the natural elasticity of the sponge." (See S. Gamgee, *London Lancet*, February, 1882.)

When rendered aseptic, "sponge combines stimulation, pressure, and drainage better than any other substance with which we are acquainted, and these are the essentials in the treatment of indolent ulcers." I have nothing to add to these views of the manner in which sponge stimulates granulation—equal elastic pressure with an antiseptic material which may be allowed to remain undisturbed in the tissues, is the whole secret of the process. All that is necessary in the sponge is to have a good quality, thoroughly cleansed of all foreign matter and rendered aseptic by any of the agents used by surgeons for that purpose.